# Role of Computed Tomography Severity Index in Acute Diagnosis and Follow-up of Acute Pancreatitis

# Akut Pankreatit Tanı ve Takibinde Bilgisayarlı Tomografi Şiddet Indexinin Rolü

Diagnosis of Acute Pancreatitis

Serap Biberoğlu[1], Murat Koyuncu[1], Derya Öztürk[2], Ahmet Cevdet Toksöz[3], Emin Çakmakcı[4], Fatih Çakmak[5], İbrahim İkizceli[2]
[1]Department of Emergency Medicine, Faculty of Medicine, Karabuk University, Karabuk,
[2]Clinical of Emergency Medicine, Sisli Hamidiye Etfal Education and Research Hospital, Istanbul,
[3]Department of Emergency Medicine, Balikesir State Hospital, Balikesir,
[4]Clinical of Radiology and Radiodiagnostic, Sami Ulus Education and Research Hospital, Ankara,
[5]Sanlıurfa Balikligol State Hospital, Sanlıurfa, Turkey

*We presented as a poster presentation in Uluslararası Acil Tıp Sempozyumu 2012, Bakü, Azerbaycan*

**Özet**

Amaç: Çalışmada; acil servislerde akut pankreatit olgularında Bilgisayarlı Tomografi ile erken tanı koymak, Bilgisayarlı Tomografi Şiddet Skorlaması ile hastalığın şiddetine göre sınıflandırarak komplikasyonların tanısındaki rolünü saptamak ve Akut Pankreatit tanısı alan olguların demografik yapı, biyokimyasal parametreler, ultrasonografi ve Bilgisayarlı Tomografi sonuçları ile morbidite, yatış süresi ve mortalite arasındaki ilşkilerin değerlendirilmesi amaçlandı. Gereç ve Yöntem: Çalışmamız, Eğitim ve Araştırma Hastanesi Acil Servisine 01/06/2010 ile 01/06/2011 tarihleri arasında başvuran 18 yaş ve üzeri Akut Pankreatit tanısı alan 76 hasta çalışmaya alındı. Hastaların, dosyaları ve otomasyon sisteminden elde edilen verileri geriye dönük olarak incelenendi ve Baltazar Sınıflaması kullanılarak Bilgisayarlı Tomografi Şiddet İndeksini değerleri elde edildi. Bulgular: Ultrasonografi özellik olan ve olmayan hastaların Bilgisayarlı Tomografi Şiddet İndeksi 3 ve üstü olan hasta oranları arasında anlamlı farklılık yoktu. Bilgisayarlı Tomografi Şiddet İndeks puanı 3 – 6 olan hastalarda, 0 – 2 Bilgisayarlı Tomografi Şiddet İndeks puanı olanlara göre anlamlı olarak daha yüksek oranda yoğun bakıma yatış vardı. Exitus olan iki hasta, Bilgisayarlı Tomografi Şiddet İndeks puanı 7 – 10 grubunda idi. Tartışma: Akut Pankreatit tanısı alan hastaların tanı ve takibinde Bilgisayarlı Tomografi önemli bir yer tutar ve gelişebilecek komplikasyonların ön görülmesinde önemli bir parametre olabilir, morbidite ve mortalitesinin tahmininde Bilgisayarlı Tomografi Şiddet İndeksi oldukça avantajlı bir yöntem olabilir.

**Anahtar Kelimeler**

Akut Pankreatit; Baltazar Sınıflaması; Bilgisayarlı Tomografi Şiddet İndeksi

**Abstract**

Aim: We aimed to identify the role that computed tomography (CT) plays in the emergency services and during treatmentin the process of establishing an early diagnosis of acute pancreatitis and detecting potential complications that can emerge. Material and Method: Seventy – six patients who presented to a Training and Research Hospital's Emergency Department and diagnosed with acute pancreatitis (AP) were included in the study. Patients' files were evaluated retrospectively and their CT severity index (CTSI) values were obtained using Balthazar classification. Results: There was no significant difference between the ratio of patients with and without ultrasonographic features and patients whose CTSI was 3 and above. The ratio of being in the intensive care unit was significantly higher in patients with CTSI scores of 3–6 when compared to those with CTSI scores of 0 – 2. Two patients who died had CTSI scores in the range of 7-10. Discussion: CT plays an important role in the diagnosis of AP and the follow-up of patients diagnosed with the disease. Thus, CT can be an important parameter in the prediction of complications, as well as a preferred method for predicting the morbidity and mortality of patients diagnosed with AP.

**Keywords**

Acute Pancreatitis; Balthazar Classification; Computed Tomography Severity Index

DOI: 10.4328/JCAM.4627 Received: 12.05.2016 Accepted: 12.08.2016 Printed: 01.03.2017 J Clin Anal Med 2017;8(2): 106-110
Corresponding Author: Serap Biberoğlu, Department of Emergency Medicine, Karabuk University, Faculty of Medicine, Karabuk, Turkey.
GSM: +905336643776 F.: +90 3704125628 E-Mail: serapbiberoglu53@hotmail.com

## Introduction

There is no gold standard for diagnosing acute pancreatitis, which makes the diagnosis of this life-threatening condition even more difficult. Amylase and lipase measurements are the primary methods used in diagnosing AP; however, specificity and sensitivity levels of these enzymes are low [1]. Computed tomography (CT) is the most dependable method for diagnosing and determining the severity of AP [2,3]. In this study, we aimed to determine the role of CT in the early diagnosis of AP patients in the emergency department and to classify the disease based on its severity using the CT findings to determine potential complications during the course of treatment. We also investigated the relationships between the patients' demographic characteristics, biochemical parameters, ultrasonography (US), and CT severity index (CTSI) scores with mortality, morbidity, and length of hospital stay.

## Material and Method

This retrospective study was conducted on adult patients, 18 years and older, who presented to a training and research hospital ED between June 1, 2010 and June 1, 2011. The ICD - 10 codes were evaluated on the hospital registry and the patient files of those diagnosed with AP were further evaluated. In this study.

Of the 104 patients diagnosed with AP during the study period, 76 met the inclusion criteria. The demographic characteristics, patient history and initial complaints, physical examination findings, clinical course, and US findings of the study group were evaluated. Their lab values were obtained from the automated laboratory record system. Abdominal CTs of the patients were separately evaluated by a radiology consultant who was blinded to the patient diagnoses and clinical course. The Balthazar classifications were determined by the same radiology consultant and the CTSI scores were calculated accordingly (Table 1). Those CTSI scores were then compared with the demographic characteristics, etiologies, initial complaints, clinical findings, laboratory values, US results, length of stay, treatment, and complications of the patients.

Table 1. Classification of CT severity in acute pancreatitis

| I. Inflammation | | Score |
|---|---|---|
| Stage A | Normal pancreas | 0 |
| Stage B | Focal or diffuse enlargement of pancreatic gland, contour irregularities, inhomogeneous parenchymal density, dilatation of the pancreatic duct, small amount of fluid collection without peripancreatic inflammation | 1 |
| Stage C | Blurred peripancreatic fat planes indicating inflammation, linear densities, pancreatic abnormalities | 2 |
| Stage D | Single ill-defined fluid collection with no detectable wall or capsule | 3 |
| Stage E | Two or more ill-defined fluid collections, or presence of gas in or around the pancreas | 4 |
| II. Pancreatic necrosis | None | 0 |
| | Less than 30% | 2 |
| | Between 31% and 50% | 4 |
| | More than 50% | 6 |

No ethics approval was sought from the ethical committee for this study as it was conducted as a retrospective archive study. Contact data of the patients were not available in the patient records, thus it was not possible to obtain consent.

Statistical Analyses: Mean and standard variation values were used in the descriptive analyses. Data distribution was tested using the Kolmogorov - Smirnov test and homogeneity of variances was evaluated. Analysis of variance (ANOVA) tests and Tukey tests were used in parametric data, while Kruskal - Wallis and Mann - Whitney U tests were used for non-parametric data. The comparison tests were conducted using chi-square tests and Fischer's exact test. All analyses were performed by SPSS software (v. 19.0). A p value less than 0.05 was considered significant.

## Results

Of the 76 patients diagnosed with AP, 13.2% were between 18 and 29 years of age, 11.8% were between 30 – 39, 13.2% were between 40 – 49, 28.9% were between 50 – 59, and 32.9% were older than 60. In addition, 61.8% of the study group were females. The time of year that the patients' complaints started was also evaluated as follows: 32.9% occurred during spring, 28.9% during fall, 22.4% during summer, and 15.8% during winter months.

The CTSI scores of our patients ranged between 0 – 2 in 42.1%, 3 – 6 in 42.1%, and 7 – 10 in 15.8% (Table 2).

Table 2. Computed tomography severity index (CTSI)

| CTSI | n | % |
|---|---|---|
| 0 – 2 | 32 | 42.1 |
| 3 – 6 | 32 | 42.1 |
| 7 – 10 | 12 | 15.8 |

When the treatment complications were evaluated, local complications developed in 10.5% of the patients, while 3.9% developed systemic complications, and 36.8% developed both local and systemic complications. No complications developed for 48.7% of the patients.

Following the ED course, 84.2% of the patients were discharged as cured, 13.2% were admitted to the ICU, and 2.6% died.

There was no significant difference between the CTSI scores and clinical parameters including pulse rate, respiration rate, body temperature, AST, ALT, GGT, LDH, creatinine, LDL, TG, calcium, amylase, lipase, and CRP ($P > 0.05$). The WBC counts of patients with CTSI scores between 0 and 2 were significantly lower compared to the group with CTSI scores between 7 and 10 ($P < 0.05$). The blood glucose levels of patients with CTSI scores between 7 and 10 were significantly higher than those with CTSI scores of 0 – 2 and 3 – 6 ($P < 0.05$). Both the Total Bilirubin and Direct Bilirubin values of patients with CTSI scores between 7 and 10 were significantly lower than those with CTSI scores of 0 – 2 and 3 – 6 ($P < 0.05$). The urea levels of patients with CTSI scores between 7 and 10 were significantly higher than those with CTSI scores of 0 – 2 and 3 – 6 ($P < 0.05$). The HDL values of patients with CTSI scores between 0 and 2 were significantly lower than those in the CTSI 7 – 10 group ($P < 0.05$). The length of hospital stay of patients with CTSI scores between 7 and 10 were significantly longer than those in the

CTSI 0 – 2 and 3 – 6 groups (P < 0.05) (Table 3).

Table 3. Comparison of laboratory test results, vital signs, and length of stay with CTSI

| | CTSI | | | |
|---|---|---|---|---|
| | 0 – 2 | 3 – 6 | 7 – 10 | |
| | Ave. ± S.D. | Ave. ± S.D. | Ave. ± S.D. | P |
| Pulse (beats per minute) | 80.9 ± 4.5 | 81.7 ± 4.0 | 83.3 ± 12.8 | 0.536 |
| Temperature | 36.7 ± 0.3 | 36.8 ± 0.5 | 36.9 ± 0.7 | 0.680 |
| Respirations | 18.3 ± 2.3 | 18.8 ± 2.0 | 19.5 ± 3.1 | 0.327 |
| WBC | 8781 ± 2966 | 11444 ± 7325 | 13865 ± 6896 | 0.030 |
| Glucose | 102.9 ± 23.1 | 112.4 ± 46.7 | 164.5 ± 110.1 | 0.005 |
| AST | 177.4 ± 169.2 | 198.0 ± 176.2 | 119.5 ± 129.7 | 0.383 |
| ALT | 188.3 ± 158.1 | 233.5 ± 156.6 | 165.1 ± 191.9 | 0.364 |
| GGT | 284.6 ± 238.5 | 377.5 ± 248.6 | 214.8 ± 200.4 | 0.093 |
| LDH | 286.1 ± 136.8 | 291.8 ± 148.4 | 311.9 ± 143.6 | 0.868 |
| Total Bilirubin | 2.8 ± 3.7 | 3.0 ± 2.6 | 1.3 ± 1.4 | 0.010 |
| Direct Bilirubin | 1.4 ± 2.1 | 1.5 ± 1.7 | 0.5 ± 0.7 | 0.004 |
| Urea | 33.8 ± 18.5 | 30.6 ± 14.9 | 72.2 ± 90.4 | 0.006 |
| Creatinine | 1.1 ± 0.9 | 0.9 ± 0.4 | 1.8 ± 2.1 | 0.652 |
| Cholesterol | 168.9 ± 31.1 | 171.0 ± 39.0 | 180.8 ± 41.1 | 0.621 |
| HDL | 54.4 ± 16.1 | 47.5 ± 12.6 | 42.2 ± 11.7 | 0.026 |
| LDL | 117.9 ± 31.5 | 119.9 ± 33.1 | 122.5 ± 55.1 | 0.931 |
| TG | 124.5 ± 51.3 | 125.6 ± 46.3 | 225.5 ± 361.1 | 0.102 |
| Calcium | 9.2 ± 0.5 | 9.3 ± 0.4 | 8.5 ± 0.9 | 0.237 |
| Amylase | 1194.4 ± 961.6 | 1268.7 ± 1121.3 | 1545.7 ± 1333.9 | 0.640 |
| Lipase | 2521.2 ± 3124.0 | 2499.5 ± 2732.8 | 3621.5 ± 4076.4 | 0.654 |
| CRP | 55.8 ± 69.5 | 97.9 ± 131 | 129.3 ± 131.3 | 0.109 |
| Length of stay (days) | 8.0 ± 6.1 | 9.5 ± 4.2 | 15.4 ± 9.3 | 0.002 |

There was no significant difference noted in patients with specific or non-specific US exam findings and those with CTSI scores of 3 and higher (P = 0.794) (Table 4).

There was no significant difference noted between the percentage of patients who received treatment and the CTSI scores (P = 0.877). The rate of admission to the ICU was higher in the CTSI 3 – 6 group compared to the CTSI 0 – 2 group (P = 0.002). The two patients who died during the ED course were in the CTSI 7 – 10 group. There was no significant difference in CTSI scores between the patients who were younger or older than 50 years (P = 0.796). A significantly higher rate of complications was observed in patients with CTSI scores of 3 – 6 and 7 – 10, compared to those in the CTSI 0 – 2 group (P = 0.000) (Table 5).

Table 4. Comparison of USG findings with CTSI

| | | | CTSI | | | | |
|---|---|---|---|---|---|---|---|
| | | | | 3 and higher | | | |
| | | | 0 – 2 | 3 – 6 | | 7 – 10 | |
| | | | n | % | n | % | n | % |
| Unremarkable | | | 4 | 40.0 | 6 | 60.0 | 0 | 0.0 |
| USG | | US exam could not be performed due to gas superposition | 7 | 53.8 | 2 | 15.4 | 4 | 30.8 |
| | Remarkable | Edematous and enlarged pancreas in the presence of decreased echogenicity | 4 | 28.6 | 9 | 64.3 | 1 | 7.1 |
| | | Pseudocyst | 0 | 0.0 | 0 | 0.0 | 2 | 100.0 |
| | | Gallstones | 12 | 66.7 | 6 | 33.3 | 0 | 0.0 |
| | | Mass lesions on the pancreatic gland | 2 | 50.0 | 1 | 25.0 | 1 | 25.0 |
| | | Edematous and enlarged pancreas in the presence of decreased echogenicity + gallstones | 2 | 15.4 | 8 | 61.5 | 3 | 23.1 |
| | | Edematous and enlarged pancreas in the presence of decreased echogenicity + pseudocyst | 0 | 0.0 | 1 | 50.0 | 1 | 50.0 |

Table 5. Comparison of treatment, prognosis, age, and complications with CTSI

| Treatment, prognosis, age, and complications | | CTSI | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | 3 and higher | | | |
| | | 0 – 2 | | 3 – 6 | | 7 – 10 | |
| | | n | % | n | % | n | % |
| Medical | | 29 | 40.8 | 30 | 42.3 | 12 | 16.9 |
| Surgical | | 2 | 40.0 | 3 | 60.0 | 0 | 0.0 |
| Cured | | 31 | 48.4 | 31 | 48.4 | 2 | 3.1 |
| Intensive care unit | | 0 | 0.0 | 2 | 20.0 | 8 | 80.0 |
| Died | | 0 | 0.0 | 0 | 0.0 | 2 | 100.0 |
| 49 years and younger | 18 – 29 | 7 | 70.0 | 3 | 30.0 | 0 | 0.0 |
| | 30 – 39 | 3 | 33.3 | 4 | 44.4 | 2 | 22.2 |
| | 40 – 49 | 2 | 20.0 | 4 | 40.0 | 4 | 40.0 |
| 50 years and older | 50 – 59 | 9 | 40.9 | 8 | 36.4 | 5 | 22.7 |
| | 60 years and older | 10 | 40.0 | 14 | 56.0 | 1 | 4.0 |
| No complication | | 27 | 73.0 | 9 | 24.3 | 1 | 2.7 |
| Complication developed | Local complication | 1 | 12.5 | 7 | 87.5 | 0 | 0.0 |
| | Systemic complication | 2 | 66.7 | 1 | 33.3 | 0 | 0.0 |
| | Local + systemic complication | 1 | 3.6 | 16 | 57.1 | 11 | 39.3 |

## Discussion

Clinical findings of AP are not reliable for determining the severity of the disease. In recent years, comparisons have been made between the CT findings and the clinical course, complications, and AP mortality. The CTSI was developed based on pancreatic inflammation and extrapancreatic spread.

Balthazar et al. [4] classified pancreatitis severity into five groups based on the CT findings (Table 1). This classification is important for determining the treatment option and estimating the prognosis.

Balthazar et al.'s method is easy and quick to conduct without the need to administer an intravenous contrast substance. The mortality and morbidity rates are 0% and 4%, respectively, in Grades A – C, while these rise to 14% and 54%, respectively, in Grades D and E. These findings indicate that cases in Grades A – C follow uncomplicated courses, whereas D and E have higher rates of mortality and morbidity [5,6]. This CT classification does not indicate pancreatic necrosis. Presence of necrosis and acute inflammation are the most important prognostic factors determined by CT (Table 1). Balthazar et al. developed the CTSI using those two prognostic factors (Table 1), since the mortality and morbidity rates have been found to rise with the amount

of necrosis [5].

The CTSI score equals the summation of the scores in columns I and II (Table 1). The mortality and morbidity are 0% when the CTSI score is 0 or 1, the mortality is 0% and morbidity is 4% when the CTSI score is 2, and mortality is 17% and morbidity is 92% when the CTSI is between 7 and 10 [5,7].

In their study, Demiral et al. found the average age of patients with AP to be 60.3 [8], while it was 59 ± 16 years in a study performed by Tamer et al. [9]. This study found that AP was most commonly observed in the age group of 60 years and above (32.9%), followed by 50 – 59 years (28.9%). Our finding of AP observed in the later stages of life is consistent with the literature.

The study conducted by Tamer et al. concluded that most AP patients were diagnosed during the spring season [9]. Similarly, we found that AP cases were more frequently diagnosed in the spring. One reason for this could be that people are more mobile during the spring months and consume more animal products, including smoked food as well as alcohol, which in turn can result in an increased prevalence of AP. The average AST, ALT, GGT, amylase, lipase, and CRP values were found to be high in our study, consistent with the literature findings [10,11].

In their study, Yardan et al. found no significant relationship between the clinical severity of the condition and the levels of serum amylase and lipase [12]. Another study also reported no correlation between the severity of AP and serum amylase/lipase levels [13]. The results of our study confirmed these findings.

In the same study, Yardan et al. also found that in only 19.7% of the patients, the abdominal US findings were consistent with AP, whereas in 47.5% of the patients, those findings were inconsistent [12]. In a similar study, Ayten et al. reported 85% consistency between US findings and AP [14]. Tamer et al. also performed US exams on all patients and their findings suggested AP in 69% of the patients, whereas the US results were negative for 31% of the patients [9]. In our study, the US exam findings were normal for 13.2% of the patients, while 23.7% had gallstones, 18.4% had an edematous and enlarged pancreas, as well as decreased echogenicity coupled with gallstones, 17.1% had incomplete exam results due to superposition of gas-filled organs, 17.1% had an edematous and enlarged pancreas in the presence of decreased echogenicity, 5.3% had mass lesions on the pancreatic gland, 2.6% had pseudocysts, and 2.6% had an edematous and enlarged pancreas in the presence of decreased echogenicity and pseudocysts. US exams can be inconclusive because of a lack of user competency, presence of intestinal gas, fat tissue, and retroperitoneal location of the pancreas [9,12,13].

When we compared the US results and CTSI in patients diagnosed with AP in our study, we found no significant difference in CTSI scores and positive or negative US results for AP. This finding is consistent with the literature.

In their study, Yardan et al. found that the CT results were consistent with AP in 80.8% of the patients, whereas they were inconsistent in 19.2% [12]. Similarly, Tamer et al. [9] found CT capable of diagnosing AP in 81% of the cases. This study used Balthazar classification and found 0 – 2 in 42.1% of the cases, 3–6 in 42.1% of the cases, and 7 – 10 in 15.8% of the cases.

Clinicians investigate relevant etiologies in patients diagnosed with AP in order to find clues that provide insight into the course of the disease, whether surgery is indicated, and if so, what the most appropriate time would be. Performing surgical treatment in patients with a mild clinical course after the AP exacerbation has ceased can protect these patients from future AP outbreaks and related complications. However, surgery can be used earlier in patients with a deteriorating clinical condition despite medical treatment [13,15]. This study found that 93.4% of the patients received medical treatment, while 6.6% underwent emergency surgery. Endoscopic retrograde cholangiopancreatography (ERCP) was performed in 27.6% of the patients who received medical treatment initially.

In their study, Mortele et al. [14] compared the CTSI scores with the clinical course of the patients and found that 1% of the patients with scores between 0 – 3 underwent surgical treatment, while the surgical rate was 26% for CTSI scores of 4 – 6, and 40% for scores of 7 – 10. Similarly, patients with CTSI scores of 0 – 3 stayed in the hospital for three days on average, CTSI of 4 – 6 stayed for nine days, and CTSI of 7 – 10 stayed for 11 days. When rates of complications were compared, 1% of patients with CTSI of 0 – 3 had systemic complications, while 21% of patients with scores of 4 – 6 and 40% in the 7 – 10 group showed signs of systemic complications. In a similar study, Rau et al. [13] found that 69% of the 104 patients had local complications. Of those, 50% of the patients had pancreatic necrosis of less than 30%, 25% had pancreatic necrosis between 30–50%, and 25% had pancreatic necrosis of more than 50%. Seventy-eight percent of AP patients were also found to have systemic complications following contrast CT in the same study. Consistent with the literature, we found that 73% (n = 27) of the patients with CTSI scores of 0 – 2 showed no signs of complications, while this figure was 24.3% (n = 9) in the CTSI 3 – 6 group and 4% (n = 1) in the CTSI 7 – 10 group. Only local complications were observed in 12.5% (n = 1) of the CTSI 0 – 2 group and in 87.5% (n = 7) in the CTSI 3 – 7 group. We detected only systemic complications in 66.7% (n = 2) of the CTSI 0 – 2 group and 33.3% (n = 1) of the CTSI 3–6 group. Local and systemic complications were present together in 3.6% (n = 1) of the CTSI 0 – 2 group, 57.1% (n = 16) of the CTSI 3 – 6 group, and finally 39.3% (n = 11) of the CTSI 7 – 10 group.

Development of a modified CTSI in 1994 and its use during the diagnosis, treatment, and follow-up of AP had been considered a tremendous achievement [5,16]. The CTSI is a scoring system based on determining the amount of pancreatic inflammation and pancreatic necrosis involved. Although it is used successfully to predict the morbidity and mortality in AP patients, the most recent research findings indicate that it has limitations showing organ failure, extrapancreatic parenchymal complications, and peripancreatic vascular complications [17,18].

Based on these results, it is logical that early determination of the clinical severity of AP will be helpful in establishing a treatment plan and planning for ICU admission. Although there are controversies about which tests to order for AP patients in the ED [19], based on the advantages of the CTSI, ordering CT early on seems reasonable. In patients with CTSI score of 0–3, there is no need for a routine CT during the follow-up. However, in the presence of clinical deterioration, development of an abscess,

pseudocysts, or other complications, then performing a follow-up CT is suggested. Even though the risk for developing local and systemic complications align with increasing CTSI scores, early CT tests are helpful to determine the prognosis, possible complications, and mortality of the patients as well as the need for ICU admission [20].

Vriens et al. have reported a good correlation between the CTSI and its components (r2 = 0.94). They also concluded that the CTSI method can be superior to Ranson's method as a prognostic indicator, since it does not only predict complications and mortality, but it is also extremely practical to perform. Vriens et al. also reported that the use of CTSI during the first 48 hours of hospital presentation can have a significant impact on determining the treatment strategy [20].

In a similar study, Koenraad et al. reported that the CTSI was a strong diagnostic tool for predicting mortality in AP patients, and that there is a correlation between the CTSI scores in mild and severe AP in predicting the length of hospital stay, treatment modalities, and development of complications [14]. However, they were unable to show a statistically significant difference in predicting the length of stay and development of organ failure between the AP patients with moderate and severe CTSI scores. On the other hand, they concluded that the CTSI is a significant prognostic indicator for determining the length of hospital stay and development of organ failure.

When we looked at the CTSI scores and the treatment modalities in our study group, we found that surgical interventions were most frequently performed in patients with CTSI scores of 3 – 6. On the other hand, patients with CTSI scores of 7 – 10 did not receive any surgical treatment, most likely due to the severity of their condition which may have resulted in delaying surgery.

We also found that the rate of ICU admission was significantly higher in the CTSI 7 – 10 group. Mortality was also observed in this group. This shows that the CTSI can be advantageous in predicting morbidity and mortality, as also suggested by Vriens et al. [20] and Koenraad et al. [14].

When we looked at the relationship between the CTSI scores and the development of complications in our study, we found that in the CTSI 7 – 10 group there was a significantly higher rate of developing both local and systemic complications, while the CTSI 3 – 6 group had a higher rate of local complications, and the CTSI 0 – 2 group had a significantly lower rate of developing any complications. These findings are in line with those of Vriens et al. and Koenraad et al. and suggest that clinicians should be aware that the CTSI can be a useful tool in predicting the development of complications.

There is no relationship between the serum amylase and lipase values and the severity of AP. Similarly, no relationship was found between US exam findings and the severity of AP. CT plays an important role in the diagnosis and follow-up of patients diagnosed with AP. The CTSI scores can be an important tool for predicting complications that can develop in AP patients, as well as morbidity and mortality rates. Further studies are needed to conclude that CTSI scoring is a useful tool in predicting complications, morbidity, and mortality in patients diagnosed with AP.

### *Limitations*

The primary limitation of our study is that we were not able to enroll all of the AP patients presented to the ED during the study period in the study, since not all patients diagnosed with AP underwent computed tomography for diagnosis.

### *Competing interests*

The authors declare that they have no competing interests.

**References**

1. Wong EC, Butch AW, Rosenblum JL. The clinical chemistry laboratory and acute pancreatitis. Clinical chemistry 1993;39:234–43.
2. Steinberg W, Tenner S. Acute pancreatitis. The New England journal of medicine 1994;330:1198–210.
3. Balthazar EJ. CT diagnosis and staging of acute pancreatitis. Radiologic clinics of North America 1989;27:19–37.
4. Balthazar EJ. Acute pancreatitis: assessment of severity with clinical and CT evaluation. Radiology 2002;223:603–13.
5. Mora A, Perez-Mateo M, Viedma JA, Carballo F, Sanchez-Paya J, Liras G. Activation of cellular immune response in acute pancreatitis. Gut 1997;40:794–7.
6. Balthazar EJ. Staging of acute pancreatitis. Radiologic clinics of North America 2002;40:1199–209.
7. Balthazar EJ, Robinson DL, Megibow AJ, Ranson JH. Acute pancreatitis: value of CT in establishing prognosis. Radiology 1990;174:331–6.
8. Demiral G, Yener O, Aksoy F, Çelik Y, Bayraktar B, Yılmaz A, Ekinci Ö, Erengül C. Akut Pankreatitli Hastalarımızın Retrospektif Olarak Değerlendirilmesi. Göztepe Tıp Dergisi 2011;26:4–9.
9. Tamer A, Yaylacı S, Demirsoy H, Nalbant A, Genç A, Demirci H, Demir MV, Uslan Mİ. Retrospective Analyses of The Acute Pancreatitis. Sakaryamj 2011;1:17–21.
10. Ojetti V, Migneco A, Manno A, Verbo A, Rizzo G, Gentiloni Silveri N. Management of acute pancreatitis in emergency. European review for medical and pharmacological sciences 2005;9:133–40.
11. Dugernier T, Dewaele J, Laterre PF. Current surgical management of acute pancreatitis. Acta chirurgica Belgica 2006;106:165–71.
12. Yardan T, Genç S, Baydın A, Nural MS, Aydın M, Aygün D. Acil Serviste Akut Pankreatit Tanısı Alan Hastaların Değerlendirilmesi. Fırat Medical Journal 2009;14:124–8.
13. Rau BM, Kemppainen EA, Gumbs AA, Buchler MW, Wegscheider K, Bassi C, Puolakkainen PA, Beger HG. Early assessment of pancreatic infections and overall prognosis in severe acute pancreatitis by procalcitonin (PCT): a prospective international multicenter study. Annals of surgery 2007;245:745–54.
14. Mortele KJ, Wiesner W, Intriere L, Shankar S, Zou KH, Kalantari BN, Perez A, vanSonnenberg E, Ros PR, Banks PA et al. A modified CT severity index for evaluating acute pancreatitis: improved correlation with patient outcome. AJR American journal of roentgenology 2004;183:1261–65.
15. Kapan M, Beyazıt Ü, Gümüş M, Önder A, Yağmur Y. The outcome of early laparoscopic cholecystectomy in patients with acute biliary pancreatitis. J Clin Exp Invest 2010;1:21–4.
16. Balthazar EJ, Freeny PC, vanSonnenberg E. Imaging and intervention in acute pancreatitis. Radiology 1994;193:297–306.
17. Mortele KJ, Mergo PJ, Taylor HM, Ernst MD, Ros PR. Renal and perirenal space involvement in acute pancreatitis: spiral CT findings. Abdominal imaging 2000;25:272–8.
18. Wiesner W, Studler U, Kocher T, Degen L, Buitrago-Tellez CH, Steinbrich W. Colonic involvement in non-necrotizing acute pancreatitis: correlation of CT findings with the clinical course of affected patients. European radiology 2003;13:897–902.
19. Karaca E. The effect of prognostic criteria on the outcome of patients with nontraumatic acute pancreatitis. Turk J Emerg Med 2008;8:18–25.
20. Vriens PW, van de Linde P, Slotema ET, Warmerdam PE, Breslau PJ. Computed tomography severity index is an early prognostic tool for acute pancreatitis. Journal of the American College of Surgeons 2005;201:497–502.

***How to cite this article:***
Biberoğlu S, Koyuncu M, Öztürk D, Toksöz AC, Çakmakcı E, Çakmak5, İkizceli Fİ. Role of Computed Tomography Severity Index in Acute Diagnosis and Follow-up of Acute Pancreatitis. J Clin Anal Med 2017;8(2): 106-110.